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ASSOCIATIVE FACILITATION IN THE RECALL AND RECOGNITION OF NOUNS EMBEDDED IN CONNECTED DISCOURSE.

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THIS STUDY WAS DESIGNED TO TEST THE HYPOTHESIS THAT ASSOCIATIVELY RELATED NOUNS EMBEDDED IN CONNECTED DISCOURSE--AT LEAST IN THE CASE OF ITEMS THAT APPEAR IN THE SAME OR IN CONTIGUOUS SENTENCES--ARE STORED MORE EFFICIENTLY THAN ASSOCIATIVELY UNRELATED NOUNS. A 2X2 FACTORIAL DESIGN WAS EMPLOYED (WITH 20 SS IN EACH GROUP) IN WHICH SS WERE ASKED TO MEMORIZE A PASSAGE THAT CONTAINED 14 GROUPS OF FOUR ASSOCIATIVELY RELATED NOUNS OR A PASSAGE THAT CONTAINED 14 GROUPS OF FOUR ASSOCIATIVELY UNRELATED NOUNS. AFTER A SINGLE EXPOSURE TO A PASSAGE, RETRIEVAL WAS TESTED BY A WRITTEN RECALL TEST OR BY A PACED SUCCESSIVE BINARY RECOGNITION-MEMORY TEST THAT WAS DESIGNED TO GREATLY REDUCE OPPORTUNITIES FOR CONSTRUCTION DURING RETRIEVAL. THE CONTEXT OF THE HIGH ASSOCIATION (HA) PASSAGE WAS THE SAME AS THE CONTEXT OF THE LOW ASSOCIATION (LA) PASSAGE. THE RESULTS SUPPORTED THE HYPOTHESIS--THE FACILITATING EFFECT OF ASSOCIATION WAS FOUND TO BE INDEPENDENT OF RETRIEVAL METHOD. THIS REPORT APPEARS IN "STUDIES IN LANGUAGE AND LANGUAGE BEHAVIOR, PROGRESS REPORT V," SEPTEMBER 1, 1967. (AUTHOR/AMM)

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Associative Facilitation in the Recall and Recognition of Nouns Embedded in Connected Discourse[1]

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This study was designed to test the hypothesis that associatively related nouns embedded in connected discourse--at least in the case of items that appear in the same or in contiguous sentences--are stored more efficiently than associatively unrelated nouns. A 2 X 2 factorial design was employed (with 20 Ss in each group) in which Ss were asked to memorize a passage that contained 14 groups of 4 associatively related nouns or a passage that contained 14 groups of 4 associatively unrelated nouns. After a single exposure to a passage, retrieval was tested by a written recall test or by a paced successive binary recognition-memory test that was designed to greatly reduce opportunities for construction during retrieval. The context of the high association (HA) passage was the same as the context of the low association (LA) passage. The results supported the hypothesis: the facilitating effect of association was found to be independent of retrieval method.

Previous research (Rosenberg, 1966; in press) has reliably confirmed the expectation that associatively related words embedded in connected discourse would be recalled better than associatively unrelated words embedded in connected discourse. This expectation was based upon some assumptions about the factors that operate during the storage and retrieval of connected discourse; e.g., the chunking (during storage) of associatively related items that occur in the same sentence or in related sentences, and the construction (during retrieval) of associates on the basis of items already recalled.

The importance of construction in the recall of structured verbal materials has been emphasized by several writers (e.g., Deese, 1961; Postman, 1964). In regard to the present problem, the results of a number of cloze studies (Rosenberg, in press) in which stimulus or response words (high- and low-strength associates from free association norms) were deleted from passages of connected discourse and Ss were required to "guess" the deleted items on the basis of the remaining context, indicated that construction could have contributed appreciably to the recall scores of the Ss in the learning

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studies who were exposed to high association passages. The question that is raised by these cloze data is whether associative facilitation in the recall of items embedded in connected discourse could be eliminated if opportunities for construction were eliminated or greatly reduced. If this did not turn out to be the case, one would have to conclude that associatively related words appearing in connected discourse are, in some manner, stored more efficiently than associatively unrelated words.

In the present study one group of Ss was exposed to a passage that contained associatively related nouns, and another group to a passage that contained associatively unrelated nouns. These groups were further subdivided into groups that received a written recall task and groups that received a paced successive binary recognition-memory task similar to one used by Lachman and Tuttle (1965) in a study of the recall and recognition of the items from passages that varied in approximation to English. The recognition-memory task was designed to eliminate or at least greatly reduce opportunities for construction and had the following characteristics: (a) key items (the high- and low-strength associates) were randomized within a long list of distracter items; (b) key items did not appear in the order in which they appeared in the passages; (c) key items rarely appeared contiguously; (d) key items were presented one at a time, auditorily, so that S could not search through the entire list for related items or for items that appeared contiguously in the passages; (e) the list was presented at a rapid rate so that S would have little time to think of the passage as a whole; (f) no words appeared on the Ss' response sheets; and (g) none of the context items from the passages appeared in the recognition list.

Method

Subjects. Eighty paid volunteers from introductory undergraduate psychology courses were assigned at random to four groups of 20 Ss each and were tested in groups of from two to five Ss.

Materials. Two learning passages were prepared, a high association (HA) passage and a low association (LA) passage, which contained the same context materials and the same group of 14 stimulus words (nouns) selected from free association norms (Palermo & Jenkins, 1964). In the HA passage

each stimulus word was accompanied by three high-strength response words, while in the LA passage the HA responses were replaced by low-strength items that were (a) comparable in Thorndike-Lorge (1944) frequency (most of the key items were AA and A words), and in length, (b) identical in grammatical class, and (c) meaningful in the context of the passage. There was a greater tendency for the key items within each group of four to elicit each other in the HA list than in the LA list, and this is reflected in the indices of inter-item associative strength for the two lists, which were respectively, 21.44 % and .02%. Twenty-four of the words in the LA list that accompanied the stimulus words did not occur at all as responses in the Palermo-Jenkins (1964) college norms, 17 occurred as idiosyncratic responses in the norms as a whole, and one occurred with a frequency of 3 in the college norms.

The two passages are reproduced below, and for the reader's convenience, the stimulus words have been placed in parentheses and the response words underlined. In all instances, the response words are the underlined items that follow the item in parentheses.

High-Association Passage

It was a Sunday afternoon in March and the air was clear and brisk. The (man) walked to the corner to meet the woman who was looking at a boy and a girl across the way. After exchanging a few words, they went to a restaurant, and as they entered, they passed someone who was examining a (table), a chair and a desk, and someone with a cloth. After they ordered, there was time to look at a newspaper, where there was a story about a (king) and a queen. It concerned a ruler who had just been given a new crown. There was also a story about a (priest) whose church was in difficulty, which went on to discuss God and religion. The front page contained an item about a (lion) that had a fight with a tiger in a zoo, and had its mane pulled. It also contained an article on (justice), law and peace written by a former judge. Their order arrived, and everything was good: the (cheese), the bread, the crackers and the milk. After they finished, they headed toward a (city) which was located near a town on the other side of the state. The country they passed through on the way was nice. When they arrived, they went directly to a (house) where a home used to be. They had to check up

on the roof and the garage. There was a (river) nearby, and the water was visible on a clear day. A lake and a stream were nearby also. The caretaker was outside with a (hammer) and a nail. A tool of some sort and a saw were on the ground. There were some (shoes) on the grass, and there was dirt on the fellow's feet. His socks and laces were discolored. Someone had left a (needle), some thread, a pin and their sewing about, and there were some (kittens), cats, dogs and mice outside, as well. It grew late and they decided to leave.

Low-Association Passage

It was a Sunday afternoon in March, and the air was clear and brisk. The (man) walked to the corner to meet the guest who was looking at a horse and a bird across the way. After exchanging a few words, they went to a restaurant, and as they entered, they passed someone who was examining a (table), a door and a post, and someone with a glass. After they ordered, there was time to look at a newspaper, where there was a story about a (king) and a nurse. It concerned a leader who had just been given a new plane. There was also a story about a (priest) whose friend was in difficulty, which went on to discuss life and industry. The front page contained an item about a (lion) that had a fight with a hound in a pit and had its fuzz pulled. It also contained an article on (justice), age and doubt, written by a former sailor. Their order arrived, and everything was good: the (cheese), the corn, the lettuce and the fish. After they finished, they headed toward a (city) which was located near a road on the other side of the valley. The region they passed through on the way was nice. When they arrived, they went directly to a (house) where a store used to be. They had to check up on the gate and the plaster. There was a (river) nearby, and the forest was visible on a clear day. A grave and a station were nearby also. The caretaker was outside with a (hammer) and a bell. A stem of some sort and a pan were on the ground. There were some (shoes) on the grass, and there was dirt on the fellow's porch. His wrists and knees were discolored. Someone had left a (needle), some metal, a hat and their violin about, and there were some (kittens), guns, rocks and oars outside as well. It grew late and they decided to leave.

If there are strong pre-experimental constraints between the context of an associative passage and the key items, recall of context items may facilitate (through construction) recall of key items. However, since it is the relationships among the key items that we are attempting to manipulate and not the relationships between the context and the key items, it is necessary to demonstrate beforehand that the context does not favor differentially HA or LA items. For this purpose, cloze data were collected on the passages (in printed form) to be used in the learning study after all of the key HA and LA items had been deleted and replaced by underlined blank spaces of uniform length. In the present case, of course, with all of the HA and LA words eliminated, the HA and LA passages are identical. It was possible, therefore, to obtain the cloze data for the HA and LA items from a single group of Ss ($N = 21$).

The cloze data were collected in a single group-testing session from Ss who were not to participate in the learning study, but who were selected at random from the same population. These Ss were told that their task was to guess the words that were deleted from the passage (with no time limitation) on the basis of the remaining context, and that they were not to leave any blanks. Each S's response sheet was scored for verbatim construction of the deleted items. However, in order to increase the sensitivity of the cloze test to contextual constraints, an item from a given group of HA or LA words was counted correct if it appeared in any one of the four positions assigned to that group in the original passage. It will be recalled that one of the words in each group of four appeared in both the HA and LA passages.

The proportion of the total number of responses made that were HA items was found to be .06, and LA items .03. While there is a difference in favor of HA items, it is slight, and can be shown to be the result primarily of constraints between the context and one group of HA items, man, woman, boy, girl. If this group is eliminated (along with its LA counterpart), the proportions in question become, for HA and LA items respectively, .03 and .02. And since these particular groups of items appear at the beginning of their respective passages, it was anticipated that they would both be subject to a strong primacy effect and not contribute to any difference that might occur in the recall of HA and LA items.

To summarize this section, it is clear that the overall probability of guessing an HA or an LA item on the basis of the remaining context is very low.

In the recognition-memory tests, the 56 key items in each condition appeared within a list of 112 distracter items that had been selected in a nonsystematic manner from among the AA and A nouns of the Thorndike and Lorge (1944) norms. Each recognition list, then, contained 168 nouns which were ordered at random in four different ways to control for possible serial effects with the following exceptions: (a) no more than two key items were allowed to occur contiguously, (b) the order in which the key items appeared among the distracters was different from the order in which they appeared in the passage, and (c) each successive group of 21 words contained seven key items (thus the key items were distributed throughout the list of distracter items). The HA and LA recognition lists were identical in all respects except that the HA lists contained the high-strength response words and the LA lists contained the low-strength response words. None of the nouns from the context of the passages appeared within the basic list of distracters.

The Ss in the recognition groups were each given two sheets of paper that contained four lists of underlined blanks numbered from 1 through 21. These eight lists were lettered from A through H. The Ss in the recall groups were given sheets of lined paper to record what they remembered. The passages and the recognition lists were recorded on magnetic tape under sound-insulated conditions in a manner that insured control of temporal factors.

Procedure. The various conditions of the experiment were presented in rotation to groups of from two to five Ss in a sound-insulated research classroom. All Ss in the experiment listened to a passage played once on a tape recorder followed by either a written recall test or a recognition-memory test. The presentation time for each passage was 1 min. - 55 sec., and the study-test interval was 4 sec. The passages had been recorded at a moderate speaking rate with normal intonation. The learning and test instructions were delivered by E prior to presentation of a passage. All Ss were told that their task was to listen to a passage and to try to remember, verbatim, as much of it as they could. The Ss in the recall condition were asked to write down as much of their particular passage as they could remember, and to guess at items they could not remember. The signal to begin writing

was the words "start writing" which was delivered by E. The recall Ss were told that they would be given ample time to complete their writing task.

The following extract from the recognition-test instructions describes the task given to the Ss in the recognition groups: For the recognition-memory task you will be presented with a long series of words, some of which were in the passage and some of which were not. The series is broken down into eight lists of 21 items each. As soon as the passage is over, I will say GET READY. At that point, direct your attention immediately to List A on the first sheet before you, with your pen or pencil poised over the first blank space. The voice on the tape recorder will then say, for example, LIST A, 1. TILE. As soon as you hear the word you are to put down a plus mark if you feel the word was in the passage or a minus mark if you feel the word was not in the passage. Be sure to put your mark in the appropriate underlined space. Since you will be given only a few seconds for each word, you must respond quickly. We will follow this same procedure throughout. When you come to the end of a list of numbered spaces, the voice will direct you to the next list by giving you its letter. Leave no blanks and don't fall behind. If you are not sure of an item, you must guess. You must not leave any blanks.

The time interval between each numbered item in the recognition lists was 3 sec. During this interval S heard a number and a word, and then recorded a plus or a minus on his response sheet. The interval between each series of 21 items was 3 sec.

Results

The main dependent variable was the total number of key words recalled or recognized correctly. The written recall protocols were scored for verbatim recall, and a key item was scored as being correct regardless of its location on the recall sheets. A key item that occurred more than once in a S's written recall was always scored as having occurred once. The recognition test sheets were also scored for the tendency to give false positives, and a second score was computed--a corrected score--using the formula

$$C - \frac{56E}{D},$$

where C is number of key words correct, E is number of false positives, and D is number of distracters. None of the Ss in the recognition condition failed to complete their task.

Table 1 contains the means and SD's for the uncorrected scores. It can be seen there that the HA groups were superior to the LA groups, and

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Insert Table 1 about here

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that the recognition condition was superior to the recall condition. A 2 X 2 factorial analysis of variance revealed an F (1,76) of 19.54, $p < .001$, for Association, and an F (1,76) of 231.08, $p < .001$, for Recall vs. Recognition. The interaction was not significant.

Group LA-Recognition recorded more false positives ($\bar{X}$ = 23.90, SD = 10.26) than Group HA-Recognition ($\bar{X}$ = 21.05, SD = 15.66), but the difference was not significant, t (38) = .68, $p > .05$. The means for the corrected scores for the HA and LA recognition groups were, respectively, 36.20 (SD = 8.11) and 28.70 (SD = 9.83). The 2 X 2 factorial analysis of variance was repeated, using the corrected scores for the recognition groups, with identical results; F (1,76) = 18.14, $p < .001$, for Association, and F (1,76) = 44.12, $p < .001$, for Recall vs. Recognition. The interaction was not significant. Since the false-positive rate was the same for both recognition groups, and since the results for the uncorrected and the corrected scores were identical, only uncorrected scores were used in subsequent analyses.

The effect of Association appeared strikingly in the case of the 14 key words--the stimulus words--which were the same for the HA and LA conditions. Table 2 contains the descriptive statistics for this measure.

Insert Table 2 about here

The trends revealed in Table 2 are the same as the trends revealed in Table 1. The analysis of variance resulted in F (1,76) = 28.87, $p < .001$, for Association, and F (1,76) = 105.65, $p < .001$, for Recall vs. Recognition. The interaction was not significant. Clearly, the stimulus words were more likely to have been recalled or recognized if they were accompanied by high-strength associates than if they were accompanied by low-strength associates.

If an S recalls one word from a group of four nouns which had appeared in the same or in contiguous sentences in connected discourse, the probability of recalling all of the other words in the group should be greater for HA items than for LA items. This prediction is predicated on the assumption that in the case of the present HA passage, associative chunking will occur during learning, and on the assumption that associative construction will occur during recall. A similar prediction is made for recognition-memory; however, in this case, such a finding would have to be attributed primarily to the storage factor. A recall-dependency score was computed for each of the Ss in the present study by dividing the number of whole groups of four nouns recalled or recognized by the number of opportunities to recall or recognize a whole group; i.e., the number of instances in which at least one of the words from a group had been recalled or recognized. It will be recalled that there were 14 groups of four key words in the HA and LA passages. The means for the HA-Recall and LA-Recall conditions were .19 and .05 respectively, and for the HA-Recognition and LA-Recognition conditions, .55 and .39. Thus, the HA group was superior to the LA group for both recognition and recall. An analysis of variance revealed, F (1,76) = 16.55, $p < .001$, for Association, and F (1,76) = 86.55, $p < .001$, for Recall vs. Recognition. The interaction was not significant.

Discussion

While the results of the present study do not rule out the possibility that construction contributes to the recall of associatively related nouns embedded in connected discourse, it is evident (within the limitations of the design and the materials of the present study) that associatively related nouns are retrieved better than associatively unrelated nouns even when opportunities for construction during retrieval are greatly reduced. In other words, associatively related nouns embedded in connected discourse (at least in the case of associates that occur in the same or in contiguous sentences) appear to be stored more efficiently than associatively unrelated nouns.

However, there is another factor that one must consider in interpreting the present results. According to traditional associative theory, whenever a word occurs, it should tend to implicitly elicit its high-strength associates. In terms of the present HA recognition lists, it is possible that since the words in the various groups of four are, in the main, associatively interrelated, the implicit occurrence of key items during retrieval (occasioned by the overt occurrence of other key items) may act as prompts to the recognition of associates that occur subsequently. In other words, while opportunities for construction may be severely limited in the present recognition-memory task, the likelihood of responding positively to a key item in the HA recognition lists may be increased by another factor operating during retrieval. This expectation is strengthened by observations of Underwood (1965) on the role of implicit associative responses in false recognition, and of Storms (1961) on associative priming in word-association tests.

If such a factor was operating in the present study, one would expect its effects to be cumulative; i.e., the likelihood of responding positively to a key HA item should increase as a function of the number of key items from a group of four that have already been presented in the recognition task. No such effect should be forthcoming in the case of the LA-Recognition condition. To test this hypothesis, a rank of one, two, three or four was assigned to each item in the 14 HA and LA word-groups (for all list orders) in terms of the order of its occurrence in its recognition list. While the items assigned each rank varied from list order to list order, the position within the list of distracter items of all items assigned the same rank was the same. The dependent variable was the proportion of Ss who responded positively to the items assigned each rank. The values for this dependent variable for ranks one, two, three and four, respectively, were, for Group HA-Recognition, .91, .86, .79, and .80, while for Group LA-Recognition they were .86, .75, .70, and .62. It can be seen that while HA Ss generally surpassed LA Ss, recognition accuracy decreased in both groups as a function of rank order, with HA Ss leveling off at rank three.

Thus, there appears to be no evidence for a prompting effect in the case of HA items, but rather a general reduction in recognition accuracy

due most likely to an accumulation of retroactive interference from the distracter items. However, it cannot be concluded that such an effect would not occur under other circumstances. One of the factors to be considered should be the rate of presentation of items in the recognition-memory task (it will be recalled that the rate in the present study was 3 sec.). In Underwood's (1965) study of false recognition, items were presented at a 10-sec. rate and S's task was to indicate whether or not each word had occurred earlier in the list. Underwood found the false recognition of HA responses (items which had not occurred earlier) to be influenced positively by the frequency with which stimulus words had occurred earlier in the list.

One other factor should be considered in interpreting the present results. We have spoken throughout of the occurrence of construction during retrieval. It is possible, however, that in a case in which some of the key HA and LA items are unintelligible during original auditory exposure to the passages, S may attempt to construct ("fill in") these items, and as the results of the cloze studies (Rosenberg, in press) suggest, the constructed items are more likely to be HA responses of the intelligible key words than LA responses. The result of such construction, of course, might be to enhance the recall and recognition scores of HA Ss. However, since, upon post-experimental questioning, all of the Ss in the present study indicated no difficulty in understanding any of the materials presented, it is unlikely that this factor contributed to the superiority of the HA condition.

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Footnote

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Table 1

Means and Standard Deviations for the Number of Key Words Recalled and Recognized (Uncorrected)

Retrieval Method	Association	
Recall	HA	LA
Mean	24.40	16.55
SD	6.57	7.37
Recognition		
Mean	49.95	41.10
SD	5.32	8.12

Table 2

Means and Standard Deviations for the Number of Stimulus Words Recalled and Recognized (Uncorrected)

Retrieval Method	Association	
Recall	HA	LA
Mean	8.55	5.45
SD	2.16	2.70
Recognition		
Mean	13.10	10.95
SD	1.07	2.44